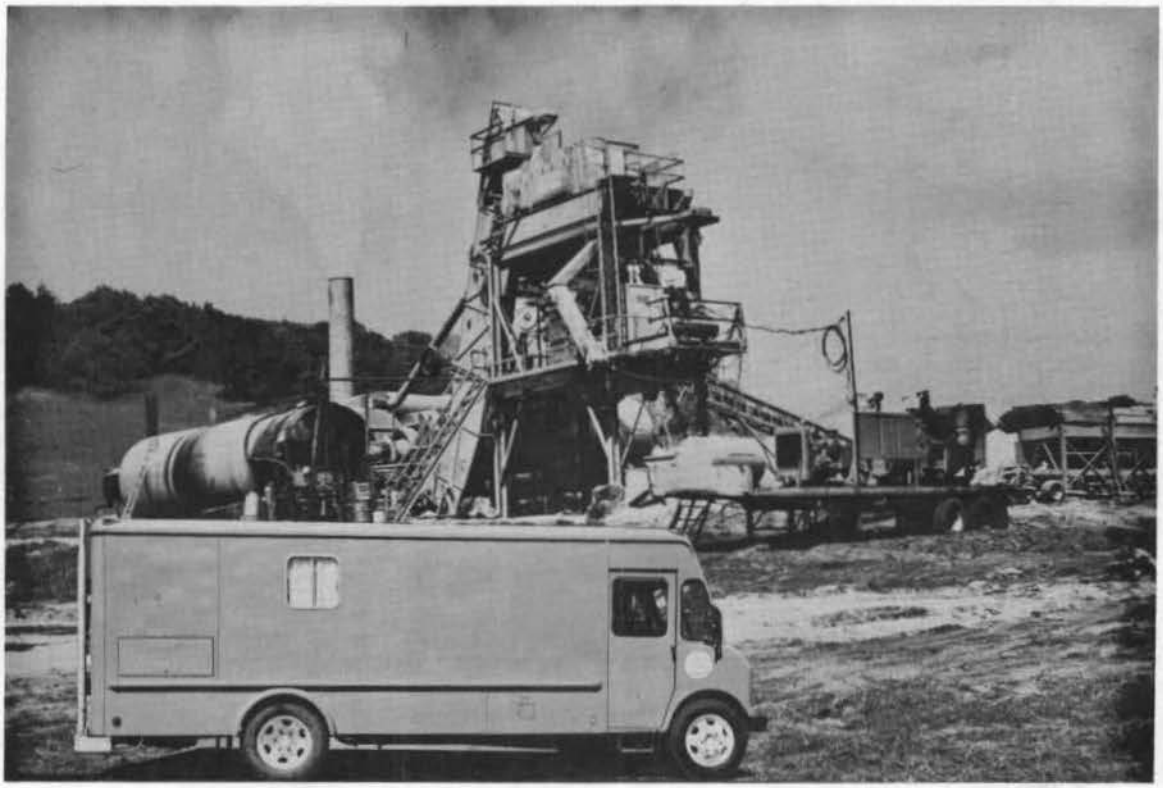
IOWA STATE HIGHWAY COMMISSION
Materials Department

SPECIAL INVESTIGATIONS

HIGHWAY RESEARCH PROJECT HR-101



MOBILE TESTING LABORATORY

FOR ASPHALTIC CONCRETE

IOWA STATE HIGHWAY COMMISSION

Materials Department

Special Investigations

H.R - 101

Final Report

also

R - 183

FIELD TESTING OF ASPHALTIC CONCRETE MIXES

March 12, 1968

by

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and

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TABLE OF CONTENTS

ACKNOWLEDGMENT

We wish to express appreciation to Steve Roberts, the Iowa Highway Research Board and Richard R. Merritt for their cooperation in making this project possible.

We also wish to thank the builders and operators listed below for their part in this project.

Builders:	Operators:
Billie Dunshee	Billie Dunshee
Karman Kellogg	Karman Kellogg
Harold Sharpnack	Paul Keigley
Carl Zeliadt	

FIELD TESTING OF ASPHALTIC CONCRETE MIXES

Problem

The amount of asphalt cement in asphaltic concrete has a definite effect on its durability under adverse conditions. The expansion of the transportation system to more and heavier loads has also made the percentage of asphalt cement in a mix more critical.

The laboratory mixer does not duplicate the mixing effect of the large pugmills; therefore, it is impossible to be completely sure of the asphalt cement needed for each mix. This percentage quite often must be varied in the field. With a central testing laboratory and the high production of mixing plants today, a large amount of asphaltic concrete is produced before a sample can be tested to determine if the asphalt content is correct. If the asphalt content lowers the durability or stability of a mix, more maintenance will be required in the future.

Purpose

The purpose of this project is to determine the value of a mobile laboratory in the field, the feasibility of providing adequate, early testing in the field, and correlation with the central laboratory. The major purpose was to determine as soon as possible the best percentage of asphalt.

Equipment

For this project a Metro Step van was purchased having inside dimensions of 23'4" long, 79" high, and 87-1/2" wide, powered by a 180 H.P. International engine.

Two walls have been built dividing the van into three rooms. The first is the entry and driving compartment, and behind that is the laboratory which is 13'4-1/2" long. At the rear there is a 5' long power compartment housing an air conditioner and generator. The laboratory compartment was insulated and paneled and the floor subfloored and tiled to improve the efficiency of the air conditioner, facilitate cleaning and improve the appearance.

The laboratory is equipped with the following:

1. Marshall molding equipment designed and built by project personnel.
2. Thelco precision oven
3. High pressure air meter
4. Hveem stabilometer
5. Controlled heat constant temperature water bath
6. Vacuum saturator
7. Compression testing machine
8. Two O'Haus balances
9. Incidental Equipment

The 10 K.V.A. single phase generator, powered by a Willy's Jeep engine, supplies 110 volt power to the laboratory and 220 volt power to the air conditioner.

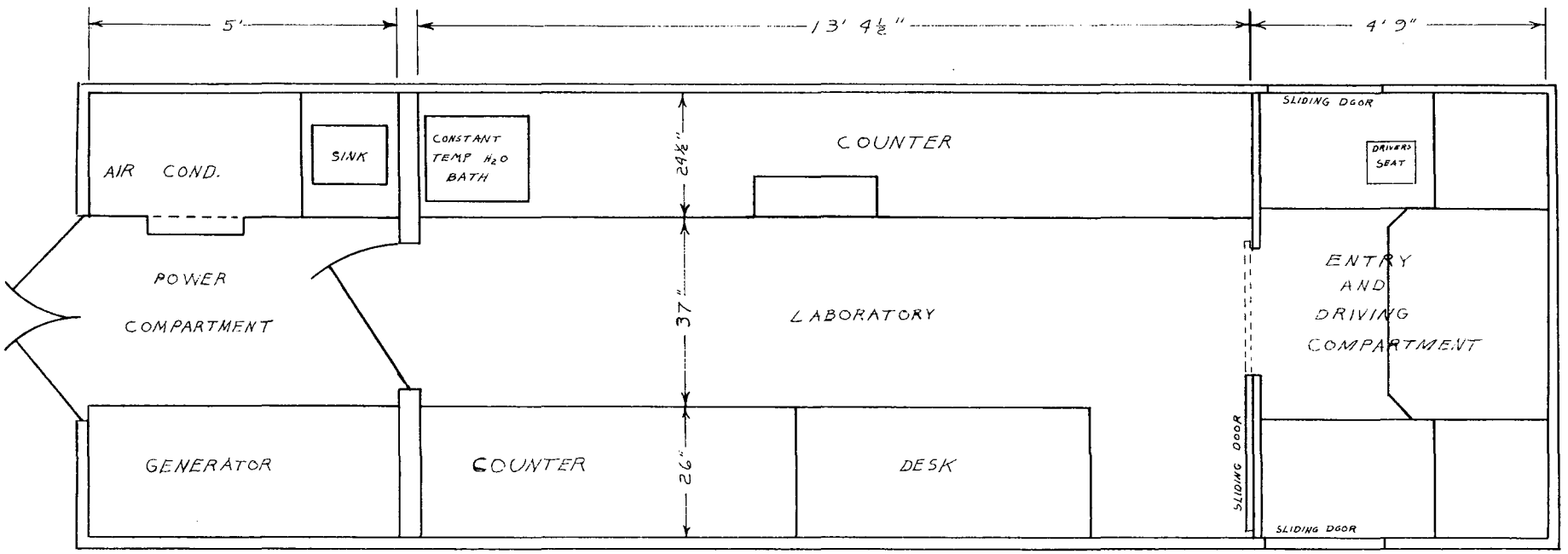
The original van was modified by additional tanks to give a gasoline capacity of 72 gallons and a water storage of 60 gallons. There is also a constant head pump to supply water pressure.

The total cost of the van, equipment and supplies (labor cost for building and operating not included) for two years was $9840.

PICTURES & SKETCH

MOBILE ASPHALT LABORATORY VAN

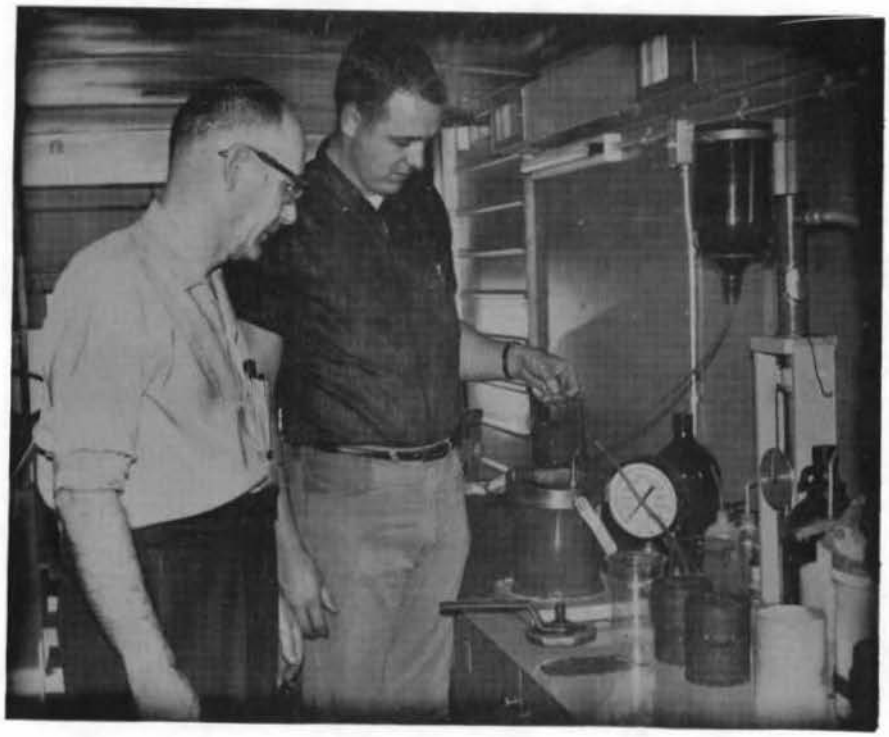
FLOOR PLAN SKETCH



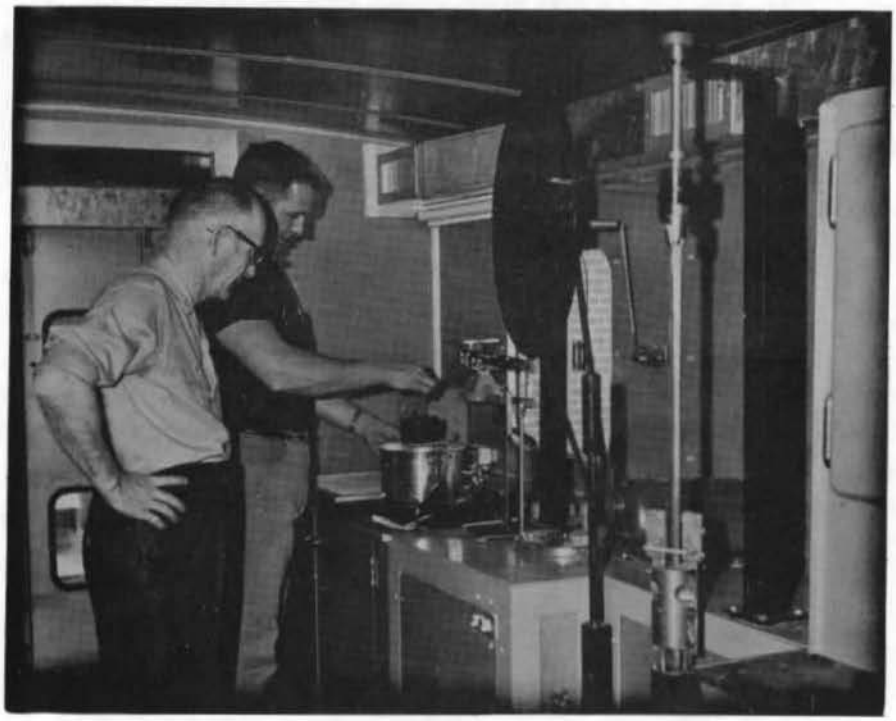
MOBILE ASPHALTIC CONCRETE FIELD TESTING LABORATORY

MOBILE ASPHALT LABORATORY VAN

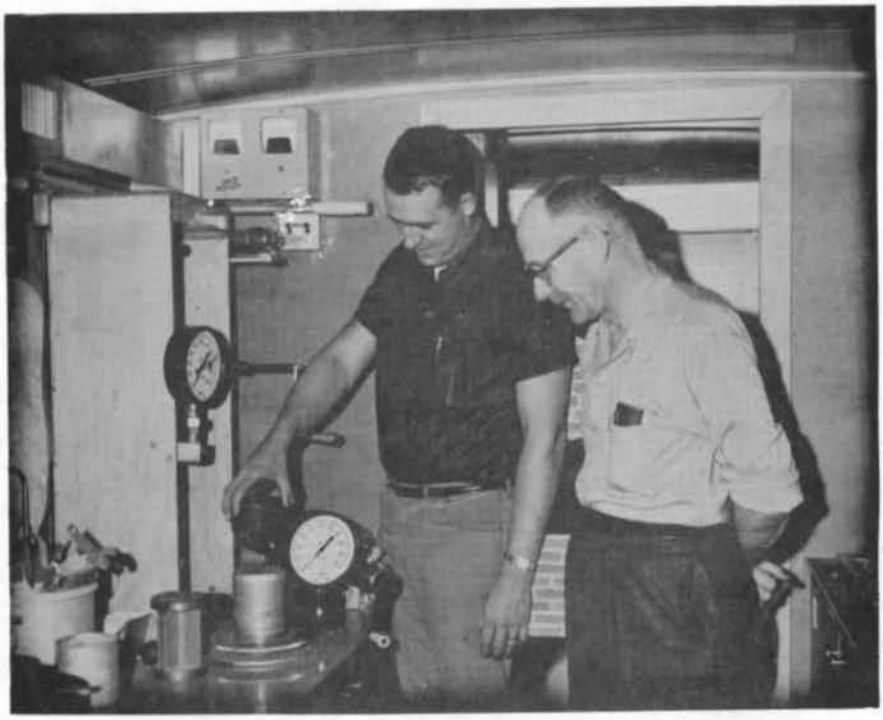
MOBILE ASPHALT LABORATORY VAN



VIEW FROM REAR TO FRONT
SHOWING THE HIGH PRESSURE AIR METER



VIEW FROM FRONT TO REAR SHOWING THE
DENSITY BY DISPLACEMENT EQUIPMENT AND
THE MARSHALL COMPACTION EQUIPMENT



VIEW FROM FRONT TO REAR SHOWING THE COMPRESSION TESTING MACHINE WITH HVEEM STABILOMETER AND ALSO SHOWING THE VACUUM SATURATER IN THE LOWER LEFT

GENERAL OVERALL VIEW FROM FRONT TO REAR

Procedure and Tests

Field testing was usually scheduled for the first or second day of mixing. It was desired to arrive at the job about noon and take the sample in the afternoon. The sample was taken with an 8" x 8" sampler behind the laydown machine from a minimum of three truck loads of mix. The sample was built up by taking smaller representative samples staggered across the width of lay. Three specimens were made by standard Marshall molding procedure in the mobile laboratory.

After the molded specimens were allowed to cool, each density was determined by the standard displacement method. The specimens were immediately placed in a constant temperature water bath for 1-1/2 hours @ 140°F., then tested for stability by the Hveem stability method. The specimens were placed in a vacuum saturating apparatus for approximately 5 minutes, then tested in the high pressure air meter.

In addition to testing the mix, two core samples were usually cut from the compacted mat, one from the same area where the sample of mix was taken and one in some other area that represents the same days run. These samples were tested for density by the displacement method and in the high pressure air meter for air voids.

When all testing was completed, a written report was made and a copy given to the construction inspector, the district materials representative, and one is retained for final reporting.

Summation of Results

The mobile laboratory started testing on April 29, 1965, visited 43 asphalt plants on 43 different projects and made 78 complete tests during 1965. Fourteen of these tests resulted in a change of the percent of asphalt cement because of information supplied by test results. Fourteen other tests were made very soon after a change in asphalt content for confirmation. There were twelve other tests made to check stability and durability of mixes for which the asphalt content had been changed more than one week prior to the visit. The balance of the 78 tests (38 tests) provided valuable information as to stability and durability but no changes were recommended.

Before the mobile laboratory was used in the field, tests by the central laboratory and mobile laboratory were correlated. Also, mobile laboratory results were compared with central laboratory results of field mix samples sent to the central laboratory. If possible, field samples taken the same day were used. The Marshall compaction procedure in the mobile laboratory resulted in the same values as that used by the central laboratory. The Hveem stability results and the voids by high pressure meter checked very closely with the central laboratory results. The "field mixed" density as run by the mobile laboratory generally seemed to be nearly the same or higher than the results of the central laboratory. This difference may result from elimination of the complete cooling and reheating process in the mobile laboratory. In general, the results obtained by the mobile laboratory correlated well enough with the central laboratory

to be accepted as equal to the central laboratory.

At the end of the 1965 season, comments from the field personnel were requested and received. In general, the reaction of the field personnel was very favorable. Specifically, they expressed a great benefit from early test results on the "field mixed" asphaltic concrete, since they must know the field mixed density, stability and air voids. Also, field personnel generally expressed high praise for the help and cooperation provided by the mobile laboratory personnel. They also expressed a desire for continued use of one or more mobile laboratories.

A few suggested facilities for running asphalt content by extraction. Some noted that the mobile laboratory showed a little higher "field mixed" density than did the central laboratory. In one instance it was reported (and disputed) that the mobile laboratory personnel had given instructions for a change in construction procedure without proper authority.

The 1966 operation of the mobile laboratory was essentially the same as 1965, visiting 42 plants on 42 different projects, providing 54 complete tests. Fourteen tests resulted in a change in asphalt content. Four tests provided results of changes made in the field. Two tests concerned a field change previously made. Thirty-four tests provided valuable assurance but no changes were recommended.

The mobile laboratory will be used in the future in the same manner. It has been found useful for many projects and critically necessary for some projects.